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EXAMINER	
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ART UNIT	**PAPER NUMBER**
2121	8

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Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No.	Applicant(s)	
	09/896,689	JACQUES, ROBERT	
	Examiner	**Art Unit**	
	Joshua C Liu	2121	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 June 2001* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,7-31* is/are rejected.

7)☒ Claim(s) *6* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 June 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2,3,7.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. Claims 1-31 have been examined.

Drawings

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description:

- Fig. 1 Elements 8, 11, and 16.
- Fig. 5 Elements 57-58.
- Fig. 6 Elements 83-84 and 86-88.
- Fig. 7.

A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

3. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

4. The abstract of the disclosure is objected to because the abstract is not in a narrative form. Correction is required. See MPEP § 608.01(b).

Double Patenting

5. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

6. Claims 1-4, 7, 12-15, and 19-21 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 4, 7, and 9 of copending Application No. 09/803,320 (Pletner et al.; Filed: 3/9/2001) in view of Jacques (IDS Reference C1).

This is a provisional obviousness-type double patenting rejection.

Claim 1

Claim 1 recites

A system for controlling the physical behavior of an apparatus, the behavior of the apparatus estimated by an initial behavioral model, the system comprising:

(a) a sensor element located in proximity to the apparatus for acquiring data indicative of the physical behavior of the apparatus;

(b) a system processor which includes a tunable controller based on the initial behavioral model, the processor capable of generating a drive signal, estimating a behavioral model, tuning and adjusting the controller and generating a control signal,

(c) wherein the processor adapts the initial model to an updated model based upon the gathered data, combines the updated model with a universal filter to create a relation that describes the behavior of

the apparatus and creates a controller based on the relation such that the controller is tuned according to the updated model, and

(d) wherein the control signal generated by the processor according to the controller is used to control the physical behavior of the apparatus.

- Regarding claim 1, Pletner's claim 9 claims a motion control system comprising:

  (a) at least two sensors for detecting at least one parameter of displacement of wafer base and producing at least two signals in response thereto (Pletner Clm. 9 L. 5-7);

  (b) a single board computer in electrical communication with actuators and said sensors; wherein, upon the detection of said at least one parameter of displacement by said sensors, said sensors signal said single board computer, which, in response, (Pletner Clm. 9 L. 9-14)

  (d) commands said actuators to track a commanded position (Pletner Clm. 9 L. 14-15).

  However, Pletner's claim 1 does not claim that (c) the single board computer adapts the initial model to an updated model based upon the gathered data and create a controller tuned according to the updated model. Jacques teaches that model tuning, which begins with an initial model and adapts the initial model to an updated model to improve the agreement between the model and the sensor data (Jacques Pg. 57 L. 15-22, "Model tuning… model synthesis method."), --gives better models than model synthesis (Jacques Pg. 57 L. 22-24, "In general,… and improve it."). Therefore, it would have been obvious to one of ordinary skill in the art, in view of Jacques, to modify Pletner by making use of

model tuning and adapting an initial model to an updated model based upon data gathered by sensors.

Claim 2

Claim 2 recites "The system of claim 1, wherein the drive signal causes motion in the apparatus."

- Regarding claim 2, see obviousness-type double patenting rejection for claim 1, *supra*, and (Pletner Clm. 9 L. 13-15, "said single board computer... a commanded position.").

Claim 3

Claim 3 recites "The system of claim 1, wherein the relation is formulated as an optimal control problem."

- Regarding claim 3, see obviousness-type double patenting rejection for claim 1, *supra*, and (Pletner Clm. 7 L. 1-3, "said control technique... mu-synthesis.").

Claim 4

Claim 4 recites "The system of claim 3, wherein the relation is solved by a method chosen from the group of methods consisting of: linear quadratic gaussian (LQG), H-infinity and mu-synthesis."

- Regarding claim 4, see obviousness-type double patenting rejection for claim 3.

Claim 7

Claim 7 recites "The system of claim 1 wherein the controller is a digital signal processor (DSP)."

- Regarding claim 7, see obviousness-type double patenting rejection for claim 1, *supra*, and (Pletner Clm. 4, "The motion control… digital signal processor.").

Claim 12

Claim 12 recites "The system of claim 1, further comprising an actuator in electrical communication with the system processor, wherein the drive signal causes activation of the actuator and wherein the actuator is located such that the physical behavior of the apparatus is modified by the activation of the actuator."

- Regarding claim 12, see obviousness-type double patenting rejection for claim 1, *supra*, and (Pletner Clm. 9 L. 13-15, "said single board computer… a commanded position.").

Claim 13

Claim 13 recites "The system of claim 12, wherein transfer function data is collected between the actuator and the sensor element."

- Regarding claim 13, see obviousness-type double patenting rejection for claim 12, *supra*, and (Jacques Fig. 3.3; Pg. 58 L. 11-20, "First, transfer functions… high precision model."), wherein during model tuning, transfer function data is collected between the actuator and the sensor elements –in order to take advantage of the usefulness of the transfer functions in closed loop analysis and the ability to remove noise effects with a minimum of computation (Jacques Pg. 58 L. 12-14, "This takes advantage… minimum of computation."). Therefore, it would have been obvious to one of ordinary skill in the art, in view of Jacques, to

modify Pletner by collecting transfer function data between the actuator and the sensor elements.

Claim 14

Claim 14 recites "The system of claim 13, wherein the sensor element gathers frequency data and wherein the accuracy of the updated model is adjustable as a function of the gathered frequency data."

- Regarding claim 14, see obviousness-type double patenting rejection for claim 13, *supra*, and (Jacques Fig. 3.3; Pg. 58 L. 11-12, "First, transfer... input/output data."; Pg. 83 L. 1-4, "Model tuning methods... system identification"; Pg. 83-104), wherein sensor elements gathers frequency data and wherein the accuracy of the tuned model is adjustable as a function of the gathered frequency data –in order to obtain a high precision model (Jacques Pg. 58 L. 15-17, "The resulting model... high precision model."). Therefore, it would have been obvious to one of ordinary skill in the art, in view of Jacques, to modify Pletner by gathering frequency data via sensor elements, wherein the accuracy of the tuned model is adjustable as a function of the gather frequency data.

Claim 15

Claim 15 recites "The system of claim 1, wherein the system processor further includes a signal conditioner."

- Regarding claim 15, see obviousness-type double patenting rejection for claim 1, *supra*, and (Pletner Clm. 9 L. 8, "a signal conditioner.").

Claim 19

Claim 19 recites "The system of claim 1, wherein the processor creates the updated model by non-linear curve-fitting thereby describing the updated model by a known mathematical equation according to the data gathered by the sensor."

- Regarding claim 19, see obviousness-type double patenting rejection for claim 1, *supra*, and (Jacques Pg. 83 L. 8-21, "In curve fitting,... second derivatives."), wherein the updated model is created by non-linear curve-fitting thereby describing the updated model by a known mathematical equation according to data gathered by the sensor (Jacques Pg. 58 L. 15-17, "The resulting model... high precision model."), --designed to solve the non-linear square problem and minimize cost function (Jacques Pg. 83 L. 8-11, "In curve fitting,... sum of quadratic values."). Therefore, it would have been obvious to one of ordinary skill in the art, in view of Jacques, to modify Pletner by having the single onboard computer create updated model using non-linear curve-fitting thereby describing the updated model by a known mathematical equation according to data gathered by the sensor.

Claim 20

Claim 20 recites "The system of claim 19, wherein an error function is associated with the known mathematical equation, the error function including log magnitude and phase information."

- Regarding claim 20, see obviousness-type double patenting rejection for claim 19, *supra*, and (Jacques Equation 3.101; Pg. 94 L. 11-24, "The most commonly..., (3.101)."), wherein the cost or error function is associated with the

known mathematical equation, the error function including log magnitude and phase information, --as the log error function is insensitive to transfer function magnitude and hence will give better fits for the zeros (Jacques Pg. 95 L. 1-7, "This cost function... the additive cost."). Therefore, it would have been obvious to one of ordinary skill in the art, in view of Jacques, to modify Pletner by using an error function that is associated with the known mathematical equation, the error function including log magnitude and phase information.

Claim 21

Claim 21 recites

The system of claim 13, wherein the logarithmic error between the collected data and the initial behavioral model is:

$$\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \sum_{i=1}^{p} \sum_{j=1}^{q} \sum_{k=1}^{N} \left| \log\left(\frac{\hat{G}_{ij}(f_k, \theta)}{G_{ik}(f_k)} \right) \right|^2,$$

where θ is a vector of parameters which describe the model, $\hat{G}_{ij}(f_k, \theta)$is the frequency response of the model from actuator j to sensor i measured at frequency f_k, $G_{ik}(f_k)$ is the measured frequency response from actuator j to sensor i measured at frequency f_k. p is the number of sensors, q is the number of actuators, and N is the number of frequency points of interest.

- Regarding claim 21, see obviousness-type double patenting rejection for claim 13, *supra*, and (Jacques Equation 3.101; Pg. 94 L. 11-24, "The most commonly..., (3.101)."), wherein the logarithmic error between the collected data and the initial behavioral model is a vector of parameters which describes the model, --as the log error function is insensitive to transfer function magnitude and hence will give better fits for the zeros (Jacques Pg. 95 L. 1-7, "This cost function... the additive cost."). Therefore, it would have been obvious to one of

ordinary skill in the art, in view of Jacques, to modify Pletner by using an error function as claimed.

Claim Objections

7. Claims 6 is objected to because of the following informalities:

- Claim 6 is objected to as being dependent upon rejected base claim 1.
- Claims 23 and 24 are objected as being dependent upon rejected base claim 22.

Appropriate correction is required.

Claim Rejections - 35 USC § 101

8. Claims 27-28 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The claims are directed to neither a "process" nor a "machine," but rather embraces or overlaps two different statutory classes of invention set forth in 35 U.S.C. 101 which is drafted so as to set forth the statutory classes of invention in the alternative only.

Claim Rejections - 35 USC § 112

9. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

10. Claims 18 and 22-24 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

- Claim 18 recites a further limitation that the relation is fully coupled, which is not disclosed in the specification.
- Claim 22-24 recite a further limitation that the relation is fully coupled, which is not disclosed in the specification.

11. Claim 27-28 are rejected under 35 USC 112 because claims 27-28 claim both an apparatus and the method step of using the apparatus.

A single claim which claims both an apparatus and the method steps of using the apparatus is indefinite under 35 U.S.C. 112, second paragraph. *In Ex parte Lyell*, 17 USPQ2d 1548 (Bd. Pat. App. & Inter. 1990), a claim directed to an automatic transmission workstand and the method steps of using it was held to be ambiguous and properly rejected under 35 U.S.C. 112, second paragraph.

Claim Rejections - 35 USC § 102

12. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

13. Claims 1-3, 5, 7, 10, 12-15, 17, 25-27, and 29-31 are rejected under 35 U.S.C. 102(b) as being anticipated by Underwood (US Patent Number 5,299,459; Issued 4/5/1994).

Claim 1

Claim 1 recites

A system for controlling the physical behavior of an apparatus, the behavior of the apparatus estimated by an initial behavioral model, the system comprising:

(a) a sensor element located in proximity to the apparatus for acquiring data indicative of the physical behavior of the apparatus;

(b) a system processor which includes a tunable controller based on the initial behavioral model, the processor capable of generating a drive signal, estimating a behavioral model, tuning and adjusting the controller and generating a control signal,

(c) wherein the processor adapts the initial model to an updated model based upon the gathered data, combines the updated model with a universal filter to create a relation that describes the behavior of the apparatus and creates a controller based on the relation such that the controller is tuned according to the updated model, and

(d) wherein the control signal generated by the processor according to the controller is used to control the physical behavior of the apparatus.

- Claim 1 is anticipated by Underwood. Underwood teaches an adaptive motion control system comprising:

  (a) (Underwood Fig. 1 Elements 12 and 32; Col 4 L. 46-48, "the sensors measure the resultant response.");

  (b) a digital processing subsystem (Underwood Fig. 1 Element 24) which includes a tunable controller (Underwood Col 3 L. 17-20, "However, the controller… drive signals accordingly.") based on the initial behavioral model (Underwood Col 3 L. 6-12, "Briefly, the preferred… reference spectral vector."), the processing system capable of generating a drive signal (Underwood Col 2 L. 50-55, "Accordingly,… near structural resonance."), estimating a behavioral model (Underwood Col 3 L. 6-12, "Briefly, the preferred… reference spectral vector."; Col 5 L. 22-26, "Initial values… at each sensor."), tuning and adjusting the controller (Underwood Col 5 L. 27-29, "An adjustment… system impedance

matrix."), and generating a control signal (Underwood Col 5 L. 33-36, "The second comparator... feed-back loop.").

(c) wherein the processing system adapts the initial model to an updated model based upon the gathered data (Underwood Col 3 L. 6-12, "Briefly, the preferred... reference spectral vector."; Col 3 L. 17-20, "However, the controller... signals accordingly."), combines the updated model with a filter to create a relation that describes the behavior of the apparatus (Underwood Col 5 L. 10-13, "The control response vector... first comparator."; Fig. 2 Element 36, "Reference Spectrum Matrix"), and creates a controller based on the relation such that the controller is tuned according to the updated model (Underwood Col 5 L. 18-20, "A compensated error... system impedance matrix."), and

(d) wherein the control signal generated by the processor according to the controller is used to control the physical behavior of the apparatus (Underwood Col 2 L. 50-68, "Accordingly... structure under test.").

Claim 2

Claim 2 recites "The system of claim 1, wherein the drive signal causes motion in the apparatus."

- Claim 2 is anticipated by Underwood. See §102 rejection of claim 1, *supra*, and (Underwood Col 2 L. 50-68, "Accordingly... structure under test.").

Claim 3

Claim 3 recites "The system of claim 1, wherein the relation is formulated as an optimal control problem."

- Claim 3 is anticipated by Underwood. See §102 rejection of claim 1, *supra*, and (Underwood Col 6 L. 36-39, "The inventor has… control problem theory.").

Claim 5

Claim 5 recites "The system of claim 1, wherein the universal filter includes a set of numbers provided by a user of the system."

- Claim 5 is anticipated by Underwood. See §102 rejection of claim 1, *supra*, and (Underwood Col 5 L. 10-18, "The control response vector… vector values."; Fig. 2 Element 36, "Reference Spectrum Matrix").

Claim 7

Claim 7 recites "The system of claim 1 wherein the controller is a digital signal processor (DSP)."

- Claim 7 is anticipated by Underwood. See §102 rejection of claim 1, *supra*, and (Underwood Fig. 1 Element 10, 14, and 20; Col 4 L. 60-Col 5 L. 10, "Referring now to… the present invention.").

Claim 10

Claim 10 recites "The system of claim 1, wherein the system begins acquiring data upon occurrence of a predefined event."

- Claim 10 is anticipated by Underwood. See §102 rejection of claim 1, *supra*, and (Underwood Col 1 L. 6-12, "The present invention… acceptable limits."; Col 3 L. 17-20, "However, the controller… drive signals accordingly."; Col 3 L. 61-65, "The inventive method… other test parameters."), wherein the system begins acquiring data when testing is initiated.

Claim 12

Claim 12 recites "The system of claim 1, further comprising an actuator in electrical communication with the system processor, wherein the drive signal causes activation of the actuator and wherein the actuator is located such that the physical behavior of the apparatus is modified by the activation of the actuator."

- Claim 12 is anticipated by Underwood. See §102 rejection of claim 1, *supra*, and (Underwood Fig. 1 Elements 26-32; Col 4 L. 46-48, "When the exciters… resultant response."). Underwood's *exciters* are *actuators*. IEEE defines an actuator as "a component that provides a physical output in response to a stimulating variable or signal" (Breitfelder Pg. 16). Underwood's exciters "may be any of the commonly available linear or rotary types of electromechanical exciter devices" (Underwood Col 4 L. 41-43; See also Col 4 L. 35-40). Electromechanical devices provide a physical output in response to a stimulating electrical signal. Therefore, Underwood's exciters are actuators.

Claim 13

Claim 13 recites "The system of claim 12, wherein transfer function data is collected between the actuator and the sensor element."

- Claim 13 is anticipated by Underwood. See §102 rejection of claim 12, *supra*, and (Underwood Fig. 1 Elements 26-32; Col 4 L. 46-48, "When the exciters… resultant response."; Col 4 L. 56-59, "Analog response signals… digital processing system.").

Claim 14

Claim 14 recites "The system of claim 13, wherein the sensor element gathers frequency data and wherein the accuracy of the updated model is adjustable as a function of the gathered frequency data."

- Claim 14 is anticipated by Underwood. See §102 rejection of claim 13, *supra*, and (Underwood Col 3 L. 61-65, "The inventive method... frequency, or with other test parameters."; Col 4 L. 46-48, "When the exciters... the resultant response."), wherein the purpose of Underwood's adaptive motion control system is to test, among other physical characteristics, the frequency of large or complex structures, and (Underwood Col 5 L. 44-61, "In mathematical terms... first test cycle."), wherein the functioning of the digital signal processing depends on *f*, or frequency of the system.

Claim 15

Claim 15 recites "The system of claim 1, wherein the system processor further includes a signal conditioner."

- Claim 15 is anticipated by Underwood. See §102 rejection of claim 1, *supra*, and (Underwood Fig. 2 Elements 38 and 50, and Elements labeled as "First Comparator" and "Compensated Error Matrix"; Col 5 10-35, "The control response... feed-back loop."), wherein the digital processing subsystem compares, compensates, and filters signal from the sensor. IEEE defines *signal conditioning* as "sensor processing involving operation such as amplification, compensation, filtering, and normalization (Breitfelder Pg. 1048). Therefore, the digital processing subsystem includes a signal conditioner.

Claim 17

Claim 17 recites "The system of claim 1, wherein the updated model is a model of minimal order."

- Claim 17 is anticipated by Underwood. See §102 rejection of claim 1, *supra*, and (Underwood Col 6 L. 36-42, "The inventor has... control dilemma.").

Claim 25

Claim 25 recites

> A method for governing motion in a physical system, the physical system being estimated by an initial behavioral model, comprising the steps of (a) inducing motion in the physical system, (b) measuring frequency data which characterizes the motion in the system, (c) updating the initial behavioral model to create an updated behavioral model which accurately conforms to the measured data, (d) using the updated behavioral model in conjunction with a universal filter to create a command structure and (e) applying appropriate stimulus to the system to cause motion in the physical system, thereby causing the physical system to behave in accordance with the command structure.

- Claim 25 is anticipated by Underwood. Underwood teaches a method for adaptive motion control of a physical system, comprising the steps of:

  (a) (Underwood Fig. 1 Elements 26 and 30; Col 4 L. 46-48, "When the exciters... the sensors measure the resultant response.");

  (b) (Underwood Fig. 1 Elements 12, 28, and 32; Col 4 L. 46-48, "the sensors measure the resultant response.");

  (c) wherein the processing system adapts the initial behavioral model to create an updated model based upon the gathered data (Underwood Col 3 L. 6-12, "Briefly, the preferred... reference spectral vector."; Col 3 L. 17-20, "However, the controller... signals accordingly.");

  (d) combines the updated model with a filter to create a relation that describes the behavior of the apparatus (Underwood Col 5 L. 10-13, "The control response

vector... first comparator."; Fig. 2 Element 36, "Reference Spectrum Matrix"; Col 5 L. 18-20, "A compensated error... system impedance matrix."), and

(e) applying the control signal generated by the processor according to cause motion in the physical system (Underwood Col 2 L. 50-68, "Accordingly... structure under test.").

Claim 26

Claim 26 recites

A method for creating an updated model for the motion characteristics of a physical system from a previously stored model of the system, the updated model governing the actions of a system controller which dictates motion in the physical system, comprising the steps of: (a) detecting the occurrence of a start event; (b) gathering data relating to the motion characteristics of the physical system; (c) updating the stored model by comparing the gathered data to the stored model; and (d) iteratively adapting the stored model until the stored model predicts the motion characteristics of the system according to the gathered data; and (e) storing the updated model at an electronic memory location accessible to the system controller.

- Claim 26 is anticipated by Underwood. Underwood teaches a method for creating an updated model for the motion characteristics of a physical system from a previously stored model of the system, comprising the steps of:

  (a) (Underwood Col 1 L. 6-12, "The present invention... acceptable limits."; Col 3 L. 17-20, "However, the controller... drive signals accordingly."; Col 3 L. 61-65, "The inventive method... other test parameters."), wherein the system detects the initiation of a testing;

  (b) (Underwood Fig. 1 Elements 12, 28, and 32; Col 4 L. 46-48, "the sensors measure the resultant response.");

  (c) (Underwood Col 5 L. 36-61, "It is important... first test cycle.");

  (d) (Underwood Col 5 L. 36-61, "It is important... first test cycle."); and

(e) (Underwood Fig. 2 Elements 14 and “Control Response Matrix”; Col 5 L. 10-11, “The control response vector… first comparator.”).

Claim 27

Claim 27 has been rejected under §101 and §112 for claiming both a system and a method. However, for the purpose of this Examination, the Examiner assumes that claim 27 depends upon claim 26 and rejects claim 27 for lack of novelty.

Claim 27 recites “The method of claim [26], wherein the step of gathering data comprises acquiring a frequency response to an induced motion to the physical system.”

- Claim 27 is anticipated by Underwood. See §102 rejection of claim 26, *supra*, and (Underwood Fig. 1 Elements 12 and 32; Col 4 L. 46-48, "the sensors measure the resultant response.").

Claim 29

Claim 29 recites

A method for controlling movement of a mechanical apparatus based on the spatial location of a movable portion of the mechanical apparatus, the movement of the portion initially estimated by a first mathematical model and governed by a first controller which is based on the first mathematical model and a mathematical filter, comprising the steps of:

(a) introducing a first signal to induce motion in the movable portion;

(b) measuring the motion and spatial location of the movable portion in response to the first signal;

(c) updating the first mathematical model to generate a second mathematical model which approximates the motion of the movable portion and updating the first controller using the second mathematical model and the filter to create and solve an optimal control problem and thereby generate a second controller, such that the motion induced when a second signal is applied to the mechanical apparatus is well-predicted.

- Claim 29 is anticipated by Underwood. Underwood teaches a method for adaptive motion control, comprising the steps of:

  (a) (Underwood Fig. 1 Elements 12 and 32; Col 4 L. 46-48, "the sensors measure the resultant response.");

  (b) (Underwood Fig. 1 Element 14; Col 4 L. 48-59, "When the exciters... digital processing system.");

  (c) (Underwood Fig. 2; Col 5 L. 10-Col 6 L. 43, "The control response... control dilemma.").

Claim 30

Claim 30 recites

A method of creating a controller of the type employed by a user to govern motion in a physical system comprising the steps of: (a) generating an identification of the system by measuring the response of the system to commands; (b) accepting input from the user specifying certain parameters of the system; (c) applying a universal filter to the input from the user to create a user-defined behavioral range

for the physical system; (d) creating a problem specification from the identification of the system and the behavioral range; and (e) solving the problem specification, thereby creating the controller.

- Claim 30 is anticipated by Underwood. Underwood teaches a method for creating a controller, comprising the steps of:

(a) (Underwood Fig. 2 Elements 14 and "Control Response Matrix"; Col 4 L. 56-66, "Analog response signals… control response vector.");

(b) (Underwood Fig. 2 Element "Reference Spectrum Matrix");

(c) (Underwood Fig. 2 Element "Reference Spectrum Matrix"; Col 5 L. 10-20, "The control response vector… system impedance matrix.");

(d) (Underwood Fig. 2 Elements "System Response Matrix", "System Impedance Matrix", and "Adjustment Gain Scalar"; Col 5 L. 20-32, "The system impedance matrix… present invention."); and

(e) (Underwood Fig. 2 Element "Compensated Error Matrix"; Col 5 L. 18-20, "A compensated error matrix… system impedance matrix.").

Claim 31

Claim 31 recites

A system for creating a controller of the type used by a user to govern motion in a physical system comprising: (a) means for generating an identification of the system by measuring the response of the system to commands; (b) means for accepting input from the user specifying certain parameters of the system; (c) means for applying a universal filter to the input from the user to create a user-defined behavioral range for the physical system; (d) means for creating a problem specification from the identification of the system and the behavioral range; and (e) means for solving the problem specification, thereby creating the controller.

- Claim 31 is anticipated by Underwood. Underwood teaches a method for creating a controller, comprising the steps of:

(a) (Underwood Fig. 2 Elements 14 and "Control Response Matrix"; Col 4 L. 56-66, "Analog response signals… control response vector.");

(b) (Underwood Fig. 2 Element "Reference Spectrum Matrix");

(c) (Underwood Fig. 2 Element "Reference Spectrum Matrix"; Col 5 L. 10-20, "The control response vector... system impedance matrix.");

(d) (Underwood Fig. 2 Elements "System Response Matrix", "System Impedance Matrix", and "Adjustment Gain Scalar"; Col 5 L. 20-32, "The system impedance matrix... present invention."); and

(e) (Underwood Fig. 2 Element "Compensated Error Matrix"; Col 5 L. 18-20, "A compensated error matrix... system impedance matrix.").

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

15. Claims 4, 19-21, and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Underwood (US Patent Number 5,299,459; Issued 4/5/1994) in view of Jacques (IDS Reference C1).

Claim 4

Claim 4 recites "The system of claim 3, wherein the relation is solved by a method chosen from the group of methods consisting of: linear quadratic gaussian (LQG), H-infinity and mu-synthesis."

- Regarding claim 4, Underwood teaches an adaptive motion control system comprising:

  (a) sensors elements (Underwood Fig. 1 Elements 12 and 32; Col 4 L. 46-48, “the sensors measure the resultant response.”);

  (b) a digital processing subsystem (Underwood Fig. 1 Element 24) which includes a tunable controller (Underwood Col 3 L. 17-20, “However, the controller… drive signals accordingly.”) based on the initial behavioral model (Underwood Col 3 L. 6-12, “Briefly, the preferred… reference spectral vector.”), the processing system capable of generating a drive signal (Underwood Col 2 L. 50-55, “Accordingly,… near structural resonance.”), estimating a behavioral model (Underwood Col 3 L. 6-12, “Briefly, the preferred… reference spectral vector.”; Col 5 L. 22-26, “Initial values… at each sensor.”), tuning and adjusting the controller (Underwood Col 5 L. 27-29, “An adjustment… system impedance matrix.”), and generating a control signal (Underwood Col 5 L. 33-36, “The second comparator… feed-back loop.”).

  (c) wherein the processing system adapts the initial model to an updated model based upon the gathered data (Underwood Col 3 L. 6-12, “Briefly, the preferred… reference spectral vector.”; Col 3 L. 17-20, “However, the controller… signals accordingly.”), combines the updated model with a filter to create a relation that describes the behavior of the apparatus (Underwood Col 5 L. 10-13, “The control response vector… first comparator.”; Fig. 2 Element 36, “Reference Spectrum Matrix”), and creates a controller based on the relation such that the

controller is tuned according to the updated model (Underwood Col 5 L. 18-20, "A compensated error... system impedance matrix."),

(d) wherein the control signal generated by the processor according to the controller is used to control the physical behavior of the apparatus (Underwood Col 2 L. 50-68, "Accordingly... structure under test."); and

(e) wherein the relation is formulated as an optimal control problem (Underwood Col 6 L. 36-39, "The inventor has... control problem theory.").

However, Underwood does not teach that the relation is solved by a method chosen from the group of methods consisting of: linear quadratic gaussian (LQG), H-infinity and mu-synthesis. Jacques teaches that LQG, H-infinity, and mu-synthesis -- provide optimal control algorithms (Jacques Pg. 34 L. 8-22, "Rovner and Cannon... the frequency response."), and are robust (Jacques Pg. 34 L. 19-20, "For robust control... or mu-synthesis.). Furthermore, the Applicant admits in Detailed Description on Pg. 8, L. 20-24 that Linear Quadratic Gaussian, H-infinity, mu-synthesis and hybrids thereof are typical analytical methods for resolving optimal control problems. Therefore, it would have been obvious to one of ordinary skill in the art to modify Underwood, in view of Jacques, by using Linear Quadratic Gaussian, H-infinity, or mu-synthesis as optimal control algorithms to resolve optimal control problems.

Claim 19

Claim 19 recites "The system of claim 1, wherein the processor creates the updated model by non-linear curve-fitting thereby describing the updated model by a known mathematical equation according to the data gathered by the sensor."

- Regarding claim 19, Underwood teaches an adaptive motion control system comprising:

  (a) sensors elements (Underwood Fig. 1 Elements 12 and 32; Col 4 L. 46-48, "the sensors measure the resultant response.");

  (b) a digital processing subsystem (Underwood Fig. 1 Element 24) which includes a tunable controller (Underwood Col 3 L. 17-20, "However, the controller... drive signals accordingly.") based on the initial behavioral model (Underwood Col 3 L. 6-12, "Briefly, the preferred... reference spectral vector."), the processing system capable of generating a drive signal (Underwood Col 2 L. 50-55, "Accordingly,... near structural resonance."), estimating a behavioral model (Underwood Col 3 L. 6-12, "Briefly, the preferred... reference spectral vector."; Col 5 L. 22-26, "Initial values... at each sensor."), tuning and adjusting the controller (Underwood Col 5 L. 27-29, "An adjustment... system impedance matrix."), and generating a control signal (Underwood Col 5 L. 33-36, "The second comparator... feed-back loop.").

  (c) wherein the processing system adapts the initial model to an updated model based upon the gathered data (Underwood Col 3 L. 6-12, "Briefly, the preferred... reference spectral vector."; Col 3 L. 17-20, "However, the controller...

signals accordingly."), combines the updated model with a filter to create a relation that describes the behavior of the apparatus (Underwood Col 5 L. 10-13, "The control response vector… first comparator."; Fig. 2 Element 36, "Reference Spectrum Matrix"), and creates a controller based on the relation such that the controller is tuned according to the updated model (Underwood Col 5 L. 18-20, "A compensated error… system impedance matrix."), and

(d) wherein the control signal generated by the processor according to the controller is used to control the physical behavior of the apparatus (Underwood Col 2 L. 50-68, "Accordingly… structure under test.").

However, Underwood does not teach that the processor creates the updated model by non-linear curve-fitting thereby describing the updated model by a known mathematical equation according to the data gathered by the sensor. Jacques teaches that an updated model can be created by non-linear curve-fitting thereby describing the updated model by a known mathematical equation according to data gathered by the sensor (Jacques Pg. 58 L. 15-17, "The resulting model… high precision model."), --which are designed to solve the non-linear square problem and minimize cost function (Jacques Pg. 83 L. 8-11, "In curve fitting,… sum of quadratic values."). Therefore, it would have been obvious to one of ordinary skill in the art to modify Underwood, in view of Jacques, by having the digital signal processor create updated model using non-linear curve-fitting thereby describing the updated model by a known mathematical equation according to data gathered by the sensor.

Claim 20

Claim 20 recites "The system of claim 19, wherein an error function is associated with the known mathematical equation, the error function including log magnitude and phase information."

- Regarding claim 20, see §103 rejection for claim 19, *supra*, and (Jacques Equation 3.101; Pg. 94 L. 11-24, "The most commonly..., (3.101)."), wherein the cost or error function is associated with the known mathematical equation, the error function including log magnitude and phase information, --as the log error function is insensitive to transfer function magnitude and hence will give better fits for the zeros (Jacques Pg. 95 L. 1-7, "This cost function... the additive cost."). Therefore, it would have been obvious to one of ordinary skill in the art to modify Underwood, in view of Jacques, by using an error function that is associated with the known mathematical equation, the error function including log magnitude and phase information.

Claim 21

Claim 21 recites

The system of claim 13, wherein the logarithmic error between the collected data and the initial behavioral model is:

$$\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \sum_{i=1}^{p} \sum_{j=1}^{q} \sum_{k=1}^{N} \left| \log\left(\frac{\hat{G}_{ij}(f_k, \theta)}{G_{ik}(f_k)} \right) \right|^2 ,$$

where θ is a vector of parameters which describe the model, $\hat{G}_{ij}(f_k, \theta)$is the frequency response of the model from actuator j to sensor i measured at frequency f_k, $G_{ik}(f_k)$ is the measured frequency response from actuator j to sensor i measured at frequency f_k. p is the number of sensors, q is the number of actuators, and N is the number of frequency points of interest.

➢ Regarding claim 21, Underwood teaches an adaptive motion control system comprising:

(a) (Underwood Fig. 1 Elements 12 and 32; Col 4 L. 46-48, "the sensors measure the resultant response.");

(b) a digital processing subsystem (Underwood Fig. 1 Element 24) which includes a tunable controller (Underwood Col 3 L. 17-20, "However, the controller... drive signals accordingly.") based on the initial behavioral model (Underwood Col 3 L. 6-12, "Briefly, the preferred... reference spectral vector."), the processing system capable of generating a drive signal (Underwood Col 2 L. 50-55, "Accordingly,... near structural resonance."), estimating a behavioral model (Underwood Col 3 L. 6-12, "Briefly, the preferred... reference spectral vector."; Col 5 L. 22-26, "Initial values... at each sensor."), tuning and adjusting the controller (Underwood Col 5 L. 27-29, "An adjustment... system impedance matrix."), and generating a control signal (Underwood Col 5 L. 33-36, "The second comparator... feed-back loop.").

(c) wherein the processing system adapts the initial model to an updated model based upon the gathered data (Underwood Col 3 L. 6-12, "Briefly, the preferred... reference spectral vector."; Col 3 L. 17-20, "However, the controller... signals accordingly."), combines the updated model with a filter to create a relation that describes the behavior of the apparatus (Underwood Col 5 L. 10-13, "The control response vector... first comparator."; Fig. 2 Element 36, "Reference Spectrum Matrix"), and creates a controller based on the relation such that the

controller is tuned according to the updated model (Underwood Col 5 L. 18-20, "A compensated error… system impedance matrix."), and

(d) wherein the control signal generated by the processor according to the controller is used to control the physical behavior of the apparatus (Underwood Col 2 L. 50-68, "Accordingly… structure under test.").

(e) actuators (Underwood Fig. 1 Elements 26-32; Col 4 L. 46-48, "When the exciters… resultant response."). Underwood's *exciters* are *actuators*. IEEE defines an actuator as "a component that provides a physical output in response to a stimulating variable or signal" (Breitfelder Pg. 16). Underwood's exciters "may be any of the commonly available linear or rotary types of electromechanical exciter devices" (Underwood Col 4 L. 41-43; See also Col 4 L. 35-40). Electromechanical devices provide a physical output in response to a stimulating electrical signal. Therefore, Underwood's exciters are actuators.

(f) wherein function data is collected between the exciters and the sensors (Underwood Fig. 1 Elements 26-32; Col 4 L. 46-48, "When the exciters… resultant response."; Col 4 L. 56-59, "Analog response signals… digital processing system.").

However, Underwood does not teach an equation for determining the logarithmic error between the collected data and the initial behavioral model. Jacques teaches an equation for determining the logarithmic error between the collected data and the initial behavioral model (Jacques Equation 3.101; Pg. 94 L. 11-24, "The most commonly…, (3.101)."), wherein the logarithmic error between the collected data and the initial

behavioral model is a vector of parameters which describes the model, --as the log error function is insensitive to transfer function magnitude and hence will give better fits for the zeros (Jacques Pg. 95 L. 1-7, "This cost function… the additive cost."). Therefore, it would have been obvious to one of ordinary skill in the art to modify Underwood, in view of Jacques, by using a logarithmic error function as claimed.

Claim 28

Claim 28 has been rejected under §101 and §112 for claiming both a system and a method. However, for the purpose of this Examination, the Examiner assumes that claim 28 depends upon claim 26 and rejects claim 28 for obviousness.

Claim 28 recites "The method of claim [26], wherein the step of gathering data comprises acquiring a frequency response to an induced motion to the physical system."

➢ Claim 28 is anticipated by Underwood. Underwood teaches a method for creating an updated model for the motion characteristics of a physical system from a previously stored model of the system, comprising the steps of:

(a) detecting the initiation of a test (Underwood Col 1 L. 6-12, "The present invention... acceptable limits."; Col 3 L. 17-20, "However, the controller... drive signals accordingly."; Col 3 L. 61-65, "The inventive method... other test parameters.");

(b) gathering data relating to the motion characteristics of the physical system (Underwood Fig. 1 Elements 12, 28, and 32; Col 4 L. 46-48, "the sensors measure the resultant response.");

(c) updating the stored model by comparing the gathered data to the stored model (Underwood Col 5 L. 36-61, "It is important... first test cycle.");

(d) iteratively adapting the stored model until the stored model predicts the motion characteristics of the system according to the gathered data (Underwood Col 5 L. 36-61, "It is important... first test cycle.");

(e) storing the updated model at an electronic memory location accessible to the system controller (Underwood Fig. 2 Elements 14 and "Control Response Matrix"; Col 5 L. 10-11, "The control response vector... first comparator.");

However, Underwood does not teach that the updated model is created by non-linear curve-fitting thereby describing the updated model by a known mathematical equation according to data gathered by the sensor. Jacques teaches the updated model is created by non-linear curve-fitting thereby

describing the updated model by a known mathematical equation according to data gathered by the sensor (Jacques Pg. 83 L. 8-21, "In curve fitting,... second derivatives."; Pg. 58 L. 15-17, "The resulting model... high precision model."), -- designed to solve the non-linear square problem and minimize cost function (Jacques Pg. 83 L. 8-11, "In curve fitting,... sum of quadratic values.").

Therefore, it would have been obvious to one of ordinary skill in the art to modify Underwood, in view of Jacques, by having the digital signal processor create updated model using non-linear curve-fitting thereby describing the updated model by a known mathematical equation according to data gathered by the sensor.

16. Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Underwood (US Patent Number 5,299,459; Issued 4/5/1994) in view of Robinson (US Patent Number 5,968,187; Issued 10/19/1999).

Claim 8

Claim 8 recites "The system of claim 1 further comprising a second processor in data communication with the system processor."

- Regarding claim 8, Underwood teaches an adaptive motion control system comprising:

  (a) sensors elements (Underwood Fig. 1 Elements 12 and 32; Col 4 L. 46-48, "the sensors measure the resultant response.");

  (b) a digital processing subsystem (Underwood Fig. 1 Element 24) which includes a tunable controller (Underwood Col 3 L. 17-20, "However, the

controller… drive signals accordingly.") based on the initial behavioral model (Underwood Col 3 L. 6-12, "Briefly, the preferred… reference spectral vector."), the processing system capable of generating a drive signal (Underwood Col 2 L. 50-55, "Accordingly,… near structural resonance."), estimating a behavioral model (Underwood Col 3 L. 6-12, "Briefly, the preferred… reference spectral vector."; Col 5 L. 22-26, "Initial values… at each sensor."), tuning and adjusting the controller (Underwood Col 5 L. 27-29, "An adjustment… system impedance matrix."), and generating a control signal (Underwood Col 5 L. 33-36, "The second comparator… feed-back loop.").

(c) wherein the processing system adapts the initial model to an updated model based upon the gathered data (Underwood Col 3 L. 6-12, "Briefly, the preferred… reference spectral vector."; Col 3 L. 17-20, "However, the controller… signals accordingly."), combines the updated model with a filter to create a relation that describes the behavior of the apparatus (Underwood Col 5 L. 10-13, "The control response vector… first comparator."; Fig. 2 Element 36, "Reference Spectrum Matrix"), and creates a controller based on the relation such that the controller is tuned according to the updated model (Underwood Col 5 L. 18-20, "A compensated error… system impedance matrix."),

(d) wherein the control signal generated by the processor according to the controller is used to control the physical behavior of the apparatus (Underwood Col 2 L. 50-68, "Accordingly… structure under test."); and

However, Underwood does not teach a second processor in data communication with the digital processing subsystem. Robinson teaches a computer system including a second processor (Robinson Fig. 1 Element 136; Fig. 2 Element 258; Col 2 L. 26-29, "One feature… the docking station."), which –provides additional processing power to the second processor and allows for remote connection of the second processor to the digital processing subsystem (Robinson Col 2 L. 30-35, "Another feature… stationary portion."). Therefore, it would have been obvious to one of ordinary skill in the art to modify Underwood, in view of Robinson, by adding a second processor in data communication with the digital processing subsystem.

Claim 9

Claim 9 recites "The system of claim 8, wherein the second processor is portable from the location of the system processor."

- Regarding claim 9, see §103 rejection for claim 8, *supra*, and (Robinson Fig. 1 Element 136; Fig. 2 Element 258), wherein the second processor (Robinson Fig. 1 Element 136; Fig. 2 Element 258; Col 2 L. 26-29, "One feature... the docking station.") is portable from the location of the digital processing subsystem, which –provides additional processing power to the portable second processor and allows for remote connection of the second processor to the digital processing subsystem (Robinson Col 2 L. 30-35, "Another feature... stationary portion."). Therefore, it would have been obvious to one of ordinary skill in the art to modify Underwood, in view of Robinson, by adding a second processor that is portable from the location of the digital processing subsystem.

17. Claims 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Underwood (US Patent Number 5,299,459; Issued 4/5/1994) in view of Yamunachari et al. (US Patent Number 5,930,476; Issued 7/27/1999).

Claim 11

Claim 11 recites "The system of claim 10, wherein the predefined event is an event selected from the group of events consisting of: input received from an operator, exceeding a threshold operating value in the apparatus, and the passage of a predetermined length of time."

➢ Regarding claim 11, Underwood teaches an adaptive motion control system comprising:

(a) sensors elements (Underwood Fig. 1 Elements 12 and 32; Col 4 L. 46-48, “the sensors measure the resultant response.”);

(b) a digital processing subsystem (Underwood Fig. 1 Element 24) which includes a tunable controller (Underwood Col 3 L. 17-20, “However, the controller… drive signals accordingly.”) based on the initial behavioral model (Underwood Col 3 L. 6-12, “Briefly, the preferred… reference spectral vector.”), the processing system capable of generating a drive signal (Underwood Col 2 L. 50-55, “Accordingly,… near structural resonance.”), estimating a behavioral model (Underwood Col 3 L. 6-12, “Briefly, the preferred… reference spectral vector.”; Col 5 L. 22-26, “Initial values… at each sensor.”), tuning and adjusting the controller (Underwood Col 5 L. 27-29, “An adjustment… system impedance matrix.”), and generating a control signal (Underwood Col 5 L. 33-36, “The second comparator… feed-back loop.”).

(c) wherein the processing system adapts the initial model to an updated model based upon the gathered data (Underwood Col 3 L. 6-12, “Briefly, the preferred… reference spectral vector.”; Col 3 L. 17-20, “However, the controller… signals accordingly.”), combines the updated model with a filter to create a relation that describes the behavior of the apparatus (Underwood Col 5 L. 10-13, “The control response vector… first comparator.”; Fig. 2 Element 36, “Reference Spectrum Matrix”), and creates a controller based on the relation such that the

controller is tuned according to the updated model (Underwood Col 5 L. 18-20, "A compensated error... system impedance matrix."),

(d) wherein the control signal generated by the processor according to the controller is used to control the physical behavior of the apparatus (Underwood Col 2 L. 50-68, "Accordingly... structure under test.");

(e) wherein the system begins acquiring data upon occurrence of a predefined event (Underwood Col 1 L. 6-12, "The present invention... acceptable limits."; Col 3 L. 17-20, "However, the controller... drive signals accordingly."; Col 3 L. 61-65, "The inventive method... other test parameters.").

However, Underwood does not teach that the predefined event is an event selected from the group of events consisting of: input received from an operator, exceeding a threshold operating value in the apparatus, and the passage of a predetermined length of time. Yamunachari teaches that predefined events is an event selected from the group of events consisting of: inputs received from an operator (Yamunachari Fig. 4; Col 2 L. 11-17, "Apparatus for automatically... associated even request."), exceeding threshold operating value in the apparatus (Yamunachari Fig. 4; Col 3 L. 19-23, "For example,... exceeding a threshold."), and the passage of a predetermined length of time (Yamunachari Fig. 4), which –allows for monitoring of devices (Yamunachari Col 2 L. 1-13, "A computer storage medium... predefined event requests."). Therefore, it would have been obvious to one of ordinary skill in the art to modify Underwood, in view of Yamunachari, by acquiring data upon occurrence of an event selected from the group of events

consisting of: inputs received from an operator, exceeding threshold operating value in the apparatus, and the passage of a predetermined length of time.

18. Claims 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Underwood (US Patent Number 5,299,459; Issued 4/5/1994) in view of Araie et al. (US Patent Number 5,523,953; Issued 6/4/1994).

Claim 16

Claim 16 recites "The system of claim 1, wherein the system processor further includes a signal amplifier."

➢ Regarding claim 16, Underwood teaches an adaptive motion control system comprising:

(a) sensors elements (Underwood Fig. 1 Elements 12 and 32; Col 4 L. 46-48, "the sensors measure the resultant response.");

(b) a digital processing subsystem (Underwood Fig. 1 Element 24) which includes a tunable controller (Underwood Col 3 L. 17-20, "However, the controller... drive signals accordingly.") based on the initial behavioral model (Underwood Col 3 L. 6-12, "Briefly, the preferred... reference spectral vector."), the processing system capable of generating a drive signal (Underwood Col 2 L. 50-55, "Accordingly,... near structural resonance."), estimating a behavioral model (Underwood Col 3 L. 6-12, "Briefly, the preferred... reference spectral vector."; Col 5 L. 22-26, "Initial values... at each sensor."), tuning and adjusting the controller (Underwood Col 5 L. 27-29, "An adjustment... system impedance

matrix."), and generating a control signal (Underwood Col 5 L. 33-36, "The second comparator... feed-back loop.").

(c) wherein the processing system adapts the initial model to an updated model based upon the gathered data (Underwood Col 3 L. 6-12, "Briefly, the preferred... reference spectral vector."; Col 3 L. 17-20, "However, the controller... signals accordingly."), combines the updated model with a filter to create a relation that describes the behavior of the apparatus (Underwood Col 5 L. 10-13, "The control response vector... first comparator."; Fig. 2 Element 36, "Reference Spectrum Matrix"), and creates a controller based on the relation such that the controller is tuned according to the updated model (Underwood Col 5 L. 18-20, "A compensated error... system impedance matrix."),

(d) wherein the control signal generated by the processor according to the controller is used to control the physical behavior of the apparatus (Underwood Col 2 L. 50-68, "Accordingly... structure under test.");

However, Underwood does not teach that the digital process subsystem includes a signal amplifier. Araie teaches usage of an amplifier (Araie Fig. 1 Element 34; Col 4 L. 67-Col 5 L. 2, "The temperature detector... from the thermosensors."), which – isolates the sensor elements from the digital processing subsystem and amplifies signals from the sensor elements (Araie Col 4 L. 67-Col 5 L. 2, "The temperature detector... from the thermosensors."). Therefore, it would have been obvious to one of ordinary skill in the art to modify Underwood, in view of Araie, by including a signal amplifier in the digital process subsystem.

Allowable Subject Matter

19. Claim 6 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joshua C Liu whose telephone number is (703) 305-6435. The examiner can normally be reached on Monday-Friday, 8:30am-5:15pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Anil Khatri can be reached on (703) 305-0282. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

jl

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